UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
PRIVATE FUEL STORAGE L.L.C.	)	Docket No. 72-22
	)	
(Private Fuel Storage Facility)	)	

DECLARATION OF DR. GEORGE H. C. LIANG

Dr. George H. C. Liang states as follows under penalties of perjury:

1. I am currently employed by Stone & Webster Engineering Corporation as a Program Manager. In this position, I am responsible for the determination and evaluation of stormwater runoff and flood events at power facilities being designed by Stone & Webster. I am providing this declaration in support of a motion for summary disposition of Contention Utah M in the above captioned proceeding to show that Private Fuel Storage L.L.C. ("PFS") has conservatively estimated the Probable Maximum Flood ("PMF") levels for the Private Fuel Storage Facility ("PFSF") and appropriately designed structures important to safety to protect against flooding.

2. My professional and educational experience is summarized in the resume attached as Exhibit 1 to this declaration. I have extensive experience in the analysis of hydrologic processes, including over 15 years experience in the calculation and evaluation of flood events and PMFs. Through my involvement in the majority of the flooding evaluations of nuclear facilities performed by Stone & Webster during this period, I am intimately familiar with the NRC requirements and standard industry practice for calculating 100 year and PMF flood events.

3. The PMF is defined as the most severe flood that is considered possible at a site as a result of the hydrologic and meteorological conditions. Unlike calculations for the 100 year flood and other flood events, which are probabilistic determinations based on recorded rainfall data, the PMF is an estimated flood event based on theoretical conditions. Thus, the PMF represents a worst case event that is unlikely to ever occur.

4. I am knowledgeable of the location of the PFSF, the hydrologic and meteorological conditions of that area, and the area's topography. I am also knowledgeable about the facility's flood protection efforts and the design of the facility's flood diversion berms.

5. The PFSF is located in the Skull Valley in Tooele County, Utah, on the Reservation of the Skull Valley Band of Goshute Indians. The restricted area in which structures, systems and components important to safety are located consists of 99 acres with elevation ranging from 4,476 ft. on its southeastern corner to 4,462 ft. on its northeastern corner. The lowest finished elevation (top of concrete) of the northern most row of concrete storage pads – which will be the lowest structures important to safety on the PFSF – will be 4,463 ft. The potential for flooding at the site has been evaluated for two drainage basins, Basin A, to the east of the site, which covers 270 sq. mi., and Basin B, generally to the north and west of the site, which covers 64 sq. mi. Basin A stretches 29.8 miles from the access road to Lookout Mountain to the south, and is defined by Hickman Knolls to the west, the Stansbury Mountains to the east and the Cedar Mountains to the south. Basin B is defined by Hickman Knolls to the east and the Lower Cedar Mountains to the west and the south. See SAR Figure 2.4-1 attached as Exhibit 2 to this declaration.

6. Based on the visual inspection of the area's topography, PFS initially used a drainage area of 26 sq. mi. to calculate a PMF of 34,577 cubic feet per second ("cfs"), as described in its June 1997 License Application. In the bases for Contention M, as admitted by the Licensing Board, the State alleged that PFS had failed to accurately estimate the PMF in that the drainage area for Basin A of 26 sq. mi. in the License Application was incorrectly determined, and that as a result of the inaccurate estimate, structures

important to safety may be inadequately designed. The State alleged that the drainage area should have been at least 240 sq. mi. and, based on that drainage area, calculated a PMF of 57,600 cfs. The State did not raise any issue in regards to PFS's evaluation of flooding for Basin B. Therefore, the remainder of my declaration will focus on Basin A.

7. After concerns were raised by both the State and the NRC Staff, PFS reexamined the drainage area and revised its calculations for Basin A to reflect a drainage basin of 270 sq. mi. PFS's revised calculations resulted in a PMF of 53,000 cfs and a 100 year flood of 2,430 cfs. The State has explicitly accepted the 270 sq. mi. drainage area as an appropriate drainage area for calculating the potential for flooding at the PFSF and has revised its estimate of the PMF to 64,500 cfs based on the 270 sq. mi. drainage area. See State of Utah's Second Amended Responses and Supplemental Responses to Applicant's First Set of Formal Discovery Requests, Cont. M, Req. for Admn. No. 1, Inter. No. 1. Thus, the State no longer challenges the adequacy of the drainage area used by PFS for calculating flooding at the site.

8. Based on subsequent discussions with the NRC, PFS adopted very conservative assumptions for the time of concentration and the infiltration rate within Basin A. As described in the May 19, 1999 License Amendment, PFS further revised its calculations to reflect these assumptions, resulting in a design PMF of 85,000 cfs. See PFSF SAR at 2.4-12. This design PMF is extremely conservative and is more than 31% larger than the 64,500 cfs peak discharge calculated by the State.

9. The State had taken issue with the time of concentration used by PFS in its calculation of the PMF. The time of concentration is the total time it takes rainfall to reach the outlet from the farthest point in the basin. The smaller the time of concentration, the greater the flood event. Another influential variable that can greatly affect the size of the flood is the infiltration rate used in calculating the PMF. The infiltration rate determines how much rainfall is absorbed by the ground instead of contributing to the storm flow. Infiltration is accounted for by either assuming a constant infiltration rate or using the Soil Conservation Service's (now the National Resources Conservation Serv-

ice) curve number (CN) method. The higher the CN, the less absorption of water by the ground and the greater the PMF.

10. The State in its PMF calculation used a smaller time of concentration than PFS did, which would increase the PMF event. However, for calculating its 85,000 cfs design PMF, PFS used a CN of 96 for calculating infiltration. A CN of 96 results in very little absorption of water by the ground and is much more conservative in this respect than the infiltration rate of .15 used by the State in its PMF calculation. It therefore greatly increases PFS's calculated PMF compared to that of the State's. The much more conservative assumption by PFS on the lack of infiltration more than offsets the State's more conservative time-of-concentration, thus resulting in PFS's PMF design basis of 85,000 cfs being more than 31% larger than the peak PMF discharge of 64,500 cfs calculated by the State.

11. Using the design PMF of 85,000 cfs, PFS calculated the elevation of the flood waters based on the basin's natural topography. As shown in Exhibit 3 attached to this declaration, the level of the flood waters in Basin A, which is east of the site, range from 4,468.8 ft (6.2 ft below the site's elevation) at the facility's southeastern corner to 4,456.7 ft (5.3 ft below the site's elevation) at the northeastern corner. Nowhere would the flood waters impinge on the PFSF site. Corresponding to the State's lower PMF estimate of 64,500 cfs, the State's estimate of flood levels would be approximately 0.5 ft. below PFS's estimate. Likewise, therefore, the PMF as calculated by the State would not result in the flooding of any portion of the PFSF site.

12. PFS then calculated the effect of the access road on the water elevation which will traverse part of Basin A up-gradient of the PFSF site. See Exhibits 2 and 3. In accordance with standard engineering practice, the access road will only be designed to pass the 100 year flood, not the PMF. Therefore, for the 85,000 cfs design basis PMF, water will accumulate behind the road to a peak elevation of 4,506.4 ft., resulting in water overtopping of the access road by 4.45 ft. After the waters overtop the access road, they will return to their natural flow pattern, as described in the preceding paragraph. Because the floodwaters will not reach the facility, the PFSF will remain flood-dry.

13. A diversion berm will be built to the east of the PFSF to prevent the flooding of the facility by the water that accumulates behind the access road, and to prevent water from crossing between the two basins. This berm will have a north-south alignment and will span 1,928 ft., extending from Hickman Knolls to several hundred feet past the access road. See SAR Figure 2.4-4, attached as Exhibit 4 to this declaration. From Hickman Knolls to the access road, the berm's elevation will be 4,507.5 ft, which be at least one foot higher than the peak elevation of 4,506.4 ft of the water accumulated behind the access road for the 85,000 cfs PMF.

14. In the State's Amended Response to the Applicant's Second Discovery Request, dated May 12, 1999, the State questions how the access road will cross the diversion berm and whether that crossing will allow flood waters to reach the PFSF. The design of this intersection is such that no path is available for flood waters to reach the facility. As shown on SAR Figure 2.4-4 (Exhibit 4), the access road will slope upwards to an elevation of 4,507.5 ft. as it approaches the diversion berm and will slope downward after it passes over the berm. Thus, the elevation of the diversion berm will continue to be at least one foot above the level of the floodwaters.

15. In summary, the PMF calculated by PFS is extremely conservative and greatly exceeds the flood flows calculated by the State. Because the PFSF is designed to address this conservatively estimated PMF, there will be no impact to public health or safety.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on June 28 1999

George H. C. Liang

Dr. George H. C. Liang